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Determinants of change on extensive livestock systems: a theoretical framework

1 - INTRODUCTION

The framework proposed in this paper results from a research conducted in the Lacope project[1] and particularly, the field study of the extensive grazing systems of the Baixo Alentejo – southern Portugal[2]. This paper constitutes an attempt to enlarge this perspective in order to respond to different typologies of extensive grazing systems that could cover most of the existing pastoral systems[3]. Nevertheless, we are aware that the proposed framework could fit better some systems than others, and it certainly demands further development and precision when used to study concrete situations, looking for enrichment from subsequent contributions.

In addition we want to underline that the aim of this framework goes well beyond the scope of a simple academic enquiry, since we are convinced that it could be a useful tool not only to understand what is at stake but also to inform policies needed to assure the sustainability of the most fragile of these systems. Furthermore, the proposed framework also seeks to highlight the most relevant interactions between aspects that are addressed by different academic fields that usually do not engage in a permanent dialogue, even when they do not completely ignore each other.

In section 2 we will provide a description of the methodology, namely the typology of the grazing systems. In section 3 we will focus on the proposed framework relying on a systems approach. Finally some concluding remarks will be made in section 4.

2 - METHODOLOGY

Spontaneous pastureland constitutes a valuable natural resource for about 70 per cent of the total area of the globe, although only 50 per cent of that area is more or less systematically used (Holecheck, Pieper, Herbel, 2004 quoting FAO, 2000).

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[1] UE project LACOPE_EVK2-2001-00259 (Landscape Development, Biodiversity and Cooperative Livestock Systems in Europe).

[2] Experience that resulted in a paper published in *Agricoltura Mediterranea* in 2005 (Vicente, Moreira, Coelho, 2005).

[3] Despite a plethora of case studies, monographs and collected papers on African and Asian pastoral systems, integrated worldwide overviews of pastoralism are surprising few (Blench, 2001).

These areas correspond to forestry areas, some desert land and natural pastureland. As in definitions proposed by several authors, it is assumed that spontaneous pastureland corresponds to non-crop land that is able to serve as habitat to domestic or wild animals. A definition that we share, considers spontaneous pastureland as non-crop land that provides food to animals through grazing as well as through the use of branches, leaves and shoots (Holecheck, Pieper, Herber, 2004).

Pastoral systems have been defined in different ways as can be observed in Hatfield and Davies (2006). However, according to these authors the most common definition follows Swift (1998) to whom «50% of the gross income from households (i.e. the value of market production and the estimated value of subsistence production consumed by households) comes from pastoralism or its related activities, or else, where more than 15% of households' food energy consumption involves the milk or dairy products they produce». They also report, with reference to Benlekhal (2004), that in Morocco pastoralism is defined as a livestock system where rangelands account for more than 50% of animal feeding time.

According to Blench (2001) extensive pastoral production «is split between the extensive enclosed systems typical of North America, Australia and parts of South America and the open-access systems in Africa, the Andes, Asia and Siberia which are still largely the province of "traditional" producers». Accepting that this broad perspective could cover most pastoral systems, nevertheless we must concede that this characterization excludes many of the existing European systems. So, even acknowledging that these systems are fragile and exhibit declining trends, we must not forget that, nevertheless, they still have an important role to play in biodiversity and the landscape, as well as the symbolic features of the rural societies, not to mention its importance from a point of view of territorial occupation and the corresponding management policies.

Therefore, since this theoretical framework was primarily devised relying on these systems, we found it necessary to add three more types to the two general types proposed by Blench. There follows a short description of the relevant features of each system, synthesized in table 1 in order to facilitate the comparison between systems. The first column of table 1 presents the attributes according to the different types to be analyzed: operation scale; livestock control; workforce; land and livestock ownership; land and water access rights and regulations.

Columns 2 and 3 describe the two Blench Pastoral systems: "traditional producers" and the "extensive enclosed systems" while columns 4, 5 and 6 refer to the other three grazing systems that can be found in Europe.

Traditional pastoral producers – Extensive pastoral systems, where large numbers of livestock are under the permanent control of herdsmen and where livestock is supposed to cover a daily number of kilometres, according to its nutritional and resting needs. In this type of pastoral system it is the tribe or the family group that is in charge of taking care of a certain number of animals. The management constraints typical of this type concern issues related to: the access to grazing land and water; the economic sustainability measured by socially acceptable levels of income and environmental problems such as over or under grazing.

Examples could be found in many areas, ranging from the Fennoscandian reindeer system to African pastoralism (Riseth, Karlsen, Ulvevadet, 2003; Caballero *et al.,* 2007). Systems that are usually related to ethnic groups, where animals

TAB. 1 – *Comparative table of different types of Extensive Grazing Systems*

Attributes		Pastoral Systems		Grazing Systems		
		Traditional pastoral producers	Enclosed systems	Small scale	Private large systems	Other types
Scale		Large to very large	Large to very large	Small	Medium to large	Medium
Workforce	Requirement livestock control	Herdsmen in permanent control	Without permanent control	Herdsmen in permanent control	Changing workforce patterns	Herdsmen in permanent control
	Work Type	Ethnic group or tribe	Wage labour	Family and co-operative labour	Mainly wage labour	Family labour
	Livestock ownership	Usually coincide	Usually do not coincide	Usually coincide	Usually do not coincide	Coincide
Resource Ownership	Land and livestock	Not coincide	Usually coincide, except when using common land	Only partially coincide	Total or partially coincide	Not coincide
	Grazing land	Mainly commons	Private and/ or commons	Mainly commons	Mainly private	Mainly private
	Access rights	Traditional	Market driven and/or traditional	Traditional	Market driven	Disputed, public regulated
Natural resource dependency	Importance of access to grazing land	Important to the system and determinant for environmental sustainability	Particularly important when the systems rely on common land	Important to the system and determinant for environmental sustainability	Important, depending on market signals and on competing uses	Determinant for economic and environmental sustainability
	Importance of access to water	According to the natural endowments from irrelevant to determinant, either to the economy of the system and to environmental sustainability	Particularly important when the systems rely on common land	According to the natural endowments from irrelevant to determinant, either to the economy of the system to the environmental sustainability	Important, depending on market signals and on competing uses	Linked to grazing land access
Regulations		Internal to the system and national regulations	National regulations	Internal to the system and national regulations	National and European regulations	National and European regulations

graze mainly on common or public land without particular concerns about grazing rights, which frequently give place to conflicts concerning the access to grazing land and to water in more arid zones.

Extensive enclosed pastoral systems – Systems based on private or public areas, usually of large and very large dimension with a very small ratio of herdsmen/livestock, therefore benefiting from scale economies, as happens in ranching systems in North and South America and Australia[4]. In this system the traditional herdsmen or cowboy tends to be substituted by a highly mobile staff that uses a mixture of means of transport, such as four wheel drive vehicles and helicopters. However, it must be noted that the capital/labour ratio depends essentially on the overall socio-economic conditions of the particular country. Management constraints are particularly related to market-driven economic profitability, regulations and environmental problems such as over or under grazing.

Small scale extensive grazing systems – involving individual or small scale cooperative livestock ownership. Animals graze on common land during a part of the year, as in the so-called Alpine systems, or go to the commons on a daily basis. This is a system that usually refers to relatively small herds (bovine, sheep or goat) that perform either long (transhumance) or short distance (transtermitance) migration patterns, between private land with relatively intensive livestock breeding and the common or free access areas (usually mountain areas), where extensive grazing needs the presence of the herdsmen to tend the animals. Main management constraints of this type are labour, economic sustainability measured by socially acceptable income and access to grazing land and water, followed by regulations and environmental problems such as over or under grazing.

With minor differences, this system is widely spread among the existing European extensive grazing systems (Caballero *et al.*, 2007; Hofstetter *et al.*, 2006 and Rodriguez Luengo, 2005). This system is also found in Portugal, covering most of the remaining extensive sheep and goat pastoralism as well as the northern small-medium cattle farmers that still use, on a daily basis, the remaining common land in conjunction with their more intensive hay meadows (Santos, 1992).

Extensive grazing systems in medium to large private farms (average ranging from 100 to 500 ha) – permanent herdsmen are replaced by relatively costly infrastructures, such as high density field division with fences and automatic water points in each fenced parcel. In this system, in the cases where land and livestock ownership do not coincide, grazing rights are regulated by the market and, therefore, no particular conflicts about grazing and water access are observed. Labour, market-driven economic profitability, regulations and environmental considerations such as over – or under – grazing are the main management constraints.

This type of extensive grazing systems could be found in Southern Iberia (Escribano Sanchez, 1995; Coelho 1997 and Coelho, Galvâo-Teles, Fragata, 2002);

Other extensive grazing systems – types defined by regulation and management constraints other than market-driven economic profitability. As it happens

[4] See http://www.answers.com/topic/ranch

in the *poligonos de pastos* of Castilla la Mancha in Spain (Caballero 2001; 2002) when land and livestock ownership do not coincide and where the grazing rights are not regulated by the market, but by state or local authorities. In this type of system the access to grazing land and water display permanent potentially conflicting situations.

The proposed framework seeks to describe the interactions between natural endowments, socio-cultural and economic factors, taking into account existing policies and regulations. This, according to the different contexts where extensive grazing systems are developed, represents a highly complex thread of interactions of causal and feedback relations, making it impossible to establish an operational mathematical model that expresses all these interconnecting relationships. The proposed framework uses instead a systems approach, pointing out the main features of extensive grazing systems and allowing an easier identification of the most relevant relations of each type (see Fig. 1). That is, to understand these highly complex systems a systems approach seems well fitted to identify the relevant questions that need to be raised when analyzing any particular extensive grazing system. In fact, the proposed framework allows us to understand better the determinants of change, as well as quickly to identify and understand the effective or potential bottlenecks that could prevent changes in some desired direction, aspects that could be very helpful for policy purposes. The focus of the framework is then the managerial decisions and the constraints that affect them.

Anyway we need to be aware that to study a particular extensive grazing system it is necessary to highlight some interconnections while for other systems the relevant interconnections and bottlenecks could be substantially different.

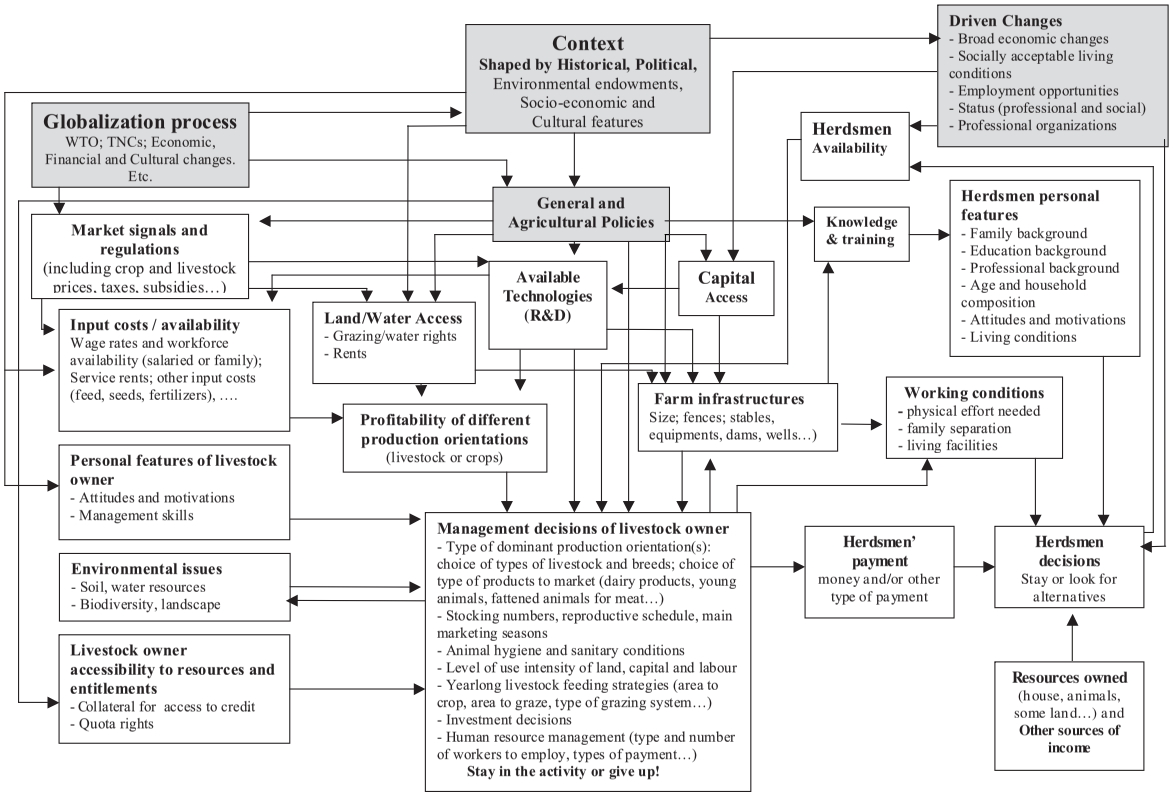
3 - THE FRAMEWORK MODEL

The diagram in figure 1 shows the basic relations that affect the sustainability of extensive grazing systems. The boundaries of the system are easily observed by looking at the diagram since the blocks outside the system have a background in green: cases that represent the context; externally driven changes, the globalization process and general and agricultural policies[5]. The great influence of these aspects on the evolution paths of the grazing systems seems clearly consensual, thus not needing further development.

When using the diagram as guide or check list to look for the main inter-relations of each system, it is advised to start with an appraisal of the historical, political**,** environmental, socio-economic and cultural context. Furthermore, we should acknowledge that this context is continuously subject to the action of external forces of change, forces that, in great part, result from the globalization process: that is, financially and economically driven globalization changes, as well as the globalization-induced cultural and societal changes.

[5] Placing general and agricultural policies as external to the system is risky. In fact it could happen that for some systems the political weight of the system stakeholders are important enough to determine policies, but in many cases this weight is so limited that we could coneive policies as being exterior to the system.

FIG. 1. - *Determinants of change in extensive livestock systems*



From a strictly economic and financial point of view, aspects extensively described in globalization literature[6], the main driving changes result from the relevance assumed by the market forces greatly reinforced by the globalization process. Two aspects deserve particular attention: on the one hand, this means that globalization forces are a powerful means to circumscribe the scale and scope of possible policies aimed at addressing the economic and environmental sustainability of the grazing systems[7]; on the other hand, this also means that in what concerns the economic sustainability of the systems more exposed to the increasing pressure from market forces, one must look at the ways followed by the grazing system to adapt to these forces, which for many systems, constitute the decisive test of sustainability.

From a strictly non-economic point of view, it must be stressed that sociocultural driven features affect the system and, in some cases, could be even more decisive than the economic features. We are referring to the forces that influence the ways the stakeholders value economic issues, as well as what can be referred to as the socially accepted behaviour of the stakeholders. This last feature intends to draw attention to the possible contradictions among stakeholders about the relevant issues for the system, namely the eventual conflicts between the herdsmen and the other stakeholders. In particular, it seems important to stress the changes involving the figure of the traditional herdsmen, and the increasing attention to environmental issues, changes that in the most developed countries are putting an extraordinary pressure on the system to adapt to these changing factors.

If this starting point about the driving forces external to the grazing systems seems uncontroversial, we feel that some kind of guidance is needed when one wants to use the diagram as a tool for analysing a particular extensive grazing system.

Our proposal is that, given a certain historical, political, economic and sociocultural context and given a certain type of environmental endowment[8], to identify the determinants of change in each grazing system one should look primarily at the following aspects from the point of view of the system's management: labour relations and availability, either family or wage labour; capital availability and/or access to capital; access to grazing areas and/or water; economic logic of functioning; innovation and technological development and environmental issues.

In brief, we propose to use these aspects as the reading grille of the diagram, which due to the limited length of the text, cannot be fully explained.

Labour relations

Labour relations and labour availability are shaped by the overall degree of economic development as well as by the political history of these relations, but they also heavily depend on the economic situation and are highly affected by the

[6] See, for instance, Almås & Lawrence (2003), Rodrik (2002), Stiglitz (2002) and UNDP (2005).

[7] It is enough to mention the "financial tyranny", very effective in constraining government expenditure (Fitoussi, 1997).

[8] For environmental endowments we mean physical local characteristics that in the short or medium term could be considered as independent of the will of the stakeholders, such as soil type, relief and climate.

changing socio-cultural context. These general features are greatly influenced by the globalization process.

A distinction between the systems dependent on wage labour and those where labour availability depends on family, tribe or ethnic group is necessary.

In the first case the system is much more dependent on alternative employment opportunities and on political issues such as human rights enforcement and power relations between labour and capital, such as the ways as in a particular country/society labour unions are accepted, praised or rejected.

In the second case, management decisions could have a more resilient stand since they are not dependent on pure economic thresholds, on the contrary, livestock owner management decisions value other considerations highly. For instance, in many of these cases abandoning the system means leaving the family and or the group, with all complex behavioural and societal aspects involved on this issue, therefore from a managerial decision point of view, family or tribal considerations could weigh much more than the usual economic rationality.

However, the resilience of the maintenance of grazing systems exposed to strong external forces should be considered without any deterministic point of view, which means that it would be very useful to look at what happened historically in industrialized countries when agricultural and rural exodus brought about huge changes in grazing infrastructures, namely fences and water points; but at the same time it is necessary to observe what happened to the traditional grazing systems in countries that did not have such a powerful external stimulus as the industrialization process.

Capital availability or capital access

Obviously capital availability or capital access is of great importance, not only as a means of access to economies of scale, but also as a means of gaining access to available technologies and to the possibility of improving the infrastructural endowment of each grazing system, aspects that have a great impact on management decisions. Once again, the range of possible situations is enormous: from situations where access to capital is easy, as for wealthy capitalist farmers with easy access to credit, due to the size of operations on private land that provides collateral to commercial credit, to the situation of a small family shepherd without land who uses mainly common grazing land, and cannot provide any kind of collateral apart from his own word or, finally, some tribe or ethnic groups to whom the very idea of credit is an alien concept.

Access to grazing land and water

Access to grazing land and water depends on formal legal apparatus but also could be regulated by collective rules that greatly depend on the historical context that gave origin to traditional rules. It should however, be remembered that laws, and particularly traditional rules are increasingly under pressure. Pressure that comes from alternative uses for the land must be mentioned, namely afforestation, energy crops for bio-ethanol or biomass for power production or bio-diesel or even for leisure purposes such as hunting facilities and tourist resorts. But the pressure could also come from the economics of the globalization process, namely market signals, or even from agricultural or environmental policies that could have great impact, in particular concerning the access to grazing and other resources.

The economic logic of functioning

After considering labour, capital and proprietary rights it is time to draw attention to the dialectic relations that connect managerial decisions with the personal features of the land- or livestock-owner. This calls for a close look at the rationale of the different decision makers that can be quite different according to personal characteristics, cultural roots and own-capital endowments. It is enough to consider the differences between the typical capitalist economic logic, closer to the "homus economicus" logic presented in economic handbooks, according to which the capitalist invests in an economic activity to obtain a profit rate at least identical to that he could obtain in any alternative financial investment with the same level of risk, clearly different from the rational of the typical small family farmer, to whom investment and work on an economic activity need to take into close consideration family behaviour and needs, not to mention the cases when the economic activity of grazing is confused and cannot be separated from the way of life of particular ethnic groups, such as the Sami people or the African pastoral peoples.

In addition to these different logics or rationales we should also add the case of land and livestock owners to whom livestock production, besides being a strictly economic activity, provides environmental rents that not only contributes to the own-consumption of valuable environmental services, but also increases the land value (Campos, Palacín, 2005). And it must also be considered whether land and livestock ownership is essentially sought for purposes of status, when wealthy people want to be recognized as successful and innovative gentlemen farmers.

Finally, the tension between the private economic logic and the higher level of social interest means that other broader economic considerations must be addressed, such as the problematic of the main threats faced by High Natural Value (HNV) farmland – intensification or abandonment. This issue raises the question about the relations between market and state and how public policies and state regulations address the problematic, when they do not completely ignore it (Caballero, 2007).

Innovation and technological development

A broad appreciation of the diagram needs also to pay attention to available technologies. A first distinction must however, be made: one aspect is the adoption and use of available technologies and the other is the access to the technology.

Concerning innovation, one must distinguish between innovation of procedures alone and/or innovation of procedures along with technological development. The first could be adopted only with recourse to improvements in the knowledge of the livestock owners whilst the second needs improvements in the infrastructure and in the equipment necessary to use new technologies. We are referring here to new technologies in a particular territory, which do not mean that these technologies are really a novelty, or putting it on other form, we are referring to available technologies.

Concerning the adoption and use of available technologies, one must have in mind that the most important distinction comes from market-driven and non-market driven or at least not fully market-driven economies. In fact, the technological treadmill concept used by Cochrane (1979) to characterize the chan-

ges in the agriculture of the USA is only valid when market signals flow freely to the stakeholders and when market competition really does exist, otherwise the economic and structural effects of the adopted technologies do not fully apply[9].

On the other hand, the access to technology depends on capital availability, but also on knowledge and on market signals and regulations that, in market economies, determine the thresholds of the possible options. However, as mentioned above, one has to keep in mind that most technologies are not neutral and involve structural effects related to their scale effects.

In short, it must be understood that in fully market-driven economies technological development and technological use depend essentially on market signals and regulations and could have differential impacts according to how those market signals are taken into consideration and the forms followed to enforce regulations.

Considering market signals, the historical trend in industrialized societies point to the quest for higher and higher levels of labour productivity, in great part to substitute the decreasing quantities of labour willing to herd the animals: either due to economic or to social reasons. Economic reasons are due to the fact that agricultural labour rarely reaches the wages of non-agricultural labour, but probably more important than wage is the social point of view, because in most cases herdsmen cannot aspire to have the same social recognition as other professions, on the contrary, they tend to be less considered when not stigmatized, not to mention the low degree of freedom concerning their use of time and leisure. It must be noticed that sometimes these latter causes are enough to overshadow possibly better economic rewards received by the herdsmen (Vicente, Moreira, Coelho, 2005).

Environmental issues

Environmental issues are usually placed at a higher level of analysis than the consideration of any particular extensive grazing system. But this does not mean that, under some particular conditions and for some types of extensive livestock systems, environmental issues could not be or should not be a preoccupation for the stakeholders. This is mainly because the changing dynamics brought about by globalization or by any other force for change can contribute to by-passing traditional forms of environmental regulations and introduce disequilibria that could be environmentally damaging. For instance, traditionally cattle grazing systems in northern Portugal (included in type c of table 1) overgrazing was not a matter of concern, since the number of bovines that used the common land had an upper limit constituted by the size of hay meadows each family possessed. Changes provoked by the decline of the system coincided with the opening up of the common land to the grazing of other species, namely wild horses and goats, which is now a matter of great concern due to cases of overgrazing.

It seems clear however, that, in practical terms, stakeholders are very slow to react to the changes and, in many cases, the environmental considerations are not sufficiently embedded in the cultural values of relevant portions of the society to

[9] Moreira (1989) provides an illustration of such a case.

a point where ample discussion of the socio-economic value of the environmental sustainability could be brought to the political agenda.

Furthermore, there are reasons to fear that under an environmentally friendly rhetoric, a number of agricultural policies will favour competing uses for the soil, making energy crops economically profitable to a point that extensive grazing cannot compete[10].

In short, environmental sustainability cannot be approached as a technical problem that could be addressed only by a particular grazing system, but it must be considered at the higher level of the sustainability of the society. This does not mean however, that at the system level it should not be a matter of concern.

It is certain that with proper technologies many of the environmental problems could be avoided or minimized but this needs a coercion device to be applied to guarantee its correct use. Nevertheless if the environmental dimension is understood as a complex social construction, tackling environmental sustainability requires that at least these questions need to be fully understood by all, or at least the most relevant, stakeholders. These aspects point to the need by a broad negotiation between the stakeholders and any kind of sustainability-enforcing authority (either the national or any other authority such as the European Union). Furthermore, when addressing the choices of appropriate technologies, one should point in the first place to the consideration and recuperation/adaptation of traditional local knowledge instead of trying to adopt new technologies without a careful appraisal of how they fit to the peculiarities of the local natural as well as social conditions.

4 - CONCLUDING REMARKS

Concluding the description of this theoretical framework we think that it is now obvious that it could be a useful tool for analysing extensive grazing systems. This conclusion derives from the following considerations.

The framework highlights the most relevant interactions between aspects that are usually addressed by different academic disciplines that frequently fail to dialogue with each other. This is the case when it seeks to look at the system's management through the optic of labour relations and availability (either family or wage labour), capital availability and/or access to capital, access to grazing areas and/or water, economic logic of functioning of the management unit, innovation and technological development available to each particular management unit and environmental issues.

Therefore using the proposed framework means to have a check list that could be useful as a guide for any type of enquiry, regardless of the aim, which is useful not only from an academic point of view, seeking to explain the functioning of the system, but also from an applied point of view, namely to assist stakeholders in achieving a particular goal.

Finally, this framework could be useful to inform policies needed to address the different levels of sustainability of these economically and socially fragile systems, and, more than this, to provide a holistic appraisal of the system that may be necessary to justify alternative choices.

[10] And not only grazing but also other food staples, as is feared by Runge and Senauer (2007).

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